

REC'D 31 OCT 2001

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## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference ./.	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB00/01821	International filing date (day/month/year) 12/05/2000	Priority date (day/month/year) 04/06/1999
International Patent Classification (IPC) or national classification and IPC B23B1/00		
Applicant UNOVA U.K. LIMITED et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 6 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 5 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand  28/09/2000	Date of completion of this report  29.10.2001
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer  Fischer, M  Telephone No. +49 89 2399 2363  

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB00/01821

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, pages:**

1-10 as originally filed

**Claims, No.:**

1-24 as received on 17/03/2001 with letter of 14/03/2001

**Drawings, sheets:**

1/1 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB00/01821

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes:	Claims	1-14, 16-24
	No:	Claims	15
Inventive step (IS)	Yes:	Claims	1-14, 16-24
	No:	Claims	15
Industrial applicability (IA)	Yes:	Claims	1-24
	No:	Claims	

2. Citations and explanations  
**see separate sheet**

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:  
**see separate sheet**

**VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:  
**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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Reference is made to the following documents:

- D1: EKSTEDT TERRY: 'CHALLENGE OF HARD TURNING' CARBIDE AND TOOL JOURNAL, US, BRIDGEVILLE, PA, vol. 19, no. 5, September 1987 (1987-09), pages 21-24-24, ISSN: 0192-8333
- D2: HASAN RIZWAN: 'Why are you still grinding?' MANUFACTURING ENGINEERING, US, DEARBORN, MI, vol. 120, no. 2, 1 February 1998 (1998-02-01), pages 76,78-80

**Re Item V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. D1 is considered to represent the most relevant prior art. D1 discloses (cf. especially page 22, right column, first paragraph) a turning process from which the subject-matter of claim 1 differs in that the computer is programmed to increase the depth of cut at intervals during the turning process so as to create in the turned surface a plurality of depressions which have a marginally smaller radius of curvature than that of the surrounding turned surface.

By means of these differing feature the resultant machined surface has a finish which, in a first approximation, is comparable to the finish achieved by grinding.

The method proposed in claim 1 of the present application must be considered as involving an inventive step (Article 33(3) PCT) because there is no indication in the available prior art that such simulation of a grinded surface could be necessary for ensuring life and/or functionality of components.

2. Claims 2 to 14 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.
3. The component claimed in claim 15 cannot be considered to be new (Article 33(2)

PCT) because such component can be compared alongside components produced by conventional techniques (cf. also page 2, second paragraph of the description).

4. The reasons given in paragraphs 1 and 2 above also apply to claims 16 to 24.

**Re Item VII**

**Certain defects in the international application**

1. The independent claims are not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art (document D1) being placed in the preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT).
2. The description is not in conformity with the claims as required by Rule 5.1(a)(iii) PCT.
3. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D1 and D2 is not mentioned in the description, nor are these documents identified therein.

**Re Item VIII**

**Certain observations on the international application**

1. Although claims 1 and 16 to 23 have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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protection is sought and in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack conciseness. Moreover, lack of clarity of the claims as a whole arises, since the plurality of independent claims makes it difficult, if not impossible, to determine the matter for which protection is sought, and places an undue burden on others seeking to establish the extent of the protection.

Hence, claims 1 and 16 to 23 do not meet the requirements of Article 6 PCT.

In order to overcome this objection, it would have been appropriate to file an amended set of claims defining the relevant subject-matter in terms of a single independent claim in each category followed by dependent claims covering features which are merely optional (Rule 6.4 PCT).

Claims

1. A turning process in which a cutting tool engages the surface of a rotating component so as to remove a helix of metal therefrom as a result of synchronisation of the relative axial movement of the tool and the component and the rotation of the latter, in which at least the depth of the cut achieved by the tool and component engagement is under the control of a computer which is programmed to increase the depth of cut at intervals during the turning process, so as to create in the turned surface a plurality of depressions which have a marginally smaller radius of curvature than that of the surrounding turned surface.
2. A process according to claim 1 in which the computer is also programmed to control the speed of rotation of the component.
3. A process according to claim 1 or claim 2 in which the computer is also programmed to control the relative axial movement between the tool and the component.
4. A process according to any one preceding claim in which preferably the computer is programmed so as to synchronize the rotation of the component and the axial movement of the tool so that the locus of the point of engagement of the tool and the component is a helix.
5. A process according to any one preceding claim in which the programming is such as to increase the depth of cut during regularly spaced apart intervals.
6. A process according to claim 5 in which the timing of the intervals is such as to produce a plurality of depressions around each revolution of the component.
7. A process according to claim 5 or claim 6 in which the timing of the intervals is adjusted from one revolution to the next so that depression do not become aligned parallel to the axis of the component.

8. A process according to any one preceding claim in which the transition between the turned surface of the component and each such depression is gradual and itself generated during more than one revolution of the component, by programming the computer to increase the depth of cut gradually over the said one or more revolutions during which the transition is to occur.
9. A process according to any one preceding claim in which at one end of such a depression the computer programme is arranged to reduce the depth of cut in a similar gradual manner over a corresponding number of revolutions of the component, back to that required to produce the turned surface of the component beyond the depression.
10. A process according to any one preceding claim in which the component is to taper in overall diameter, and the depth of cut instructions generated by the programme during the transitions and during the generation of each reduced diameter region takes this into account, so that the diameter of the component is progressively reduced during the whole of the turning process.
11. A process according to any one preceding claim in which the final surface specification includes a bearing ratio vector requirement, which is achieved by adjusting the rate of change of radius (diameter) at one or both ends of each depression so that the required percentage of component material will exist at the specified depths relative to the peak diameter of the turned surface.
12. A process according to any one preceding claim in which a bluing gauge percentage figure has to be complied with, and the computer is programmed to adjust the extent of the depressions relative to the remaining area of the turned component surface, so as to provide a sufficient overall area of turned surface which will be inked by the gauge during a bluing test, relative to the overall area of the depressions which will not normally become inked during the test.



13. A process according to any one preceding claim, in which the final surface is to be capable of being tested at any point along its axial length, wherein the programme arranged for the depressions to be are evenly distributed over the overall surface of the component to ensure that measurements made on the component will tend to be the same wherever they are made.
14. A process according to any one preceding claim, in which the component is to be gauged as part of the control of the turning process, wherein the programme organises the computer to store co-ordinates of the depressions and transitions or an algorithm of their generation, so that an appropriate correction can be made to the result of any gauged value of (say) diameter, or the position at which a gauge is to be applied can be determined in advance of the gauging step and the gauge or the component positioned accordingly before the measurement is made.
15. A component when manufactured in accordance with a computer controlled hard turning process as claimed in any one preceding claim.
16. A metal turning machine and computer control therefor programmed to perform a hard turning operation as claimed in any one of claims 1 to 14.
17. A computer when programmed to control a metal working machine so as to perform a hard turning process as claimed in any one of claims 1 to 14 on a component.
18. A programme adapted to operate a computer so as to provide control signals for a metal working machine to cause the latter to perform a hard turning process as claimed in any one of claims 1 to 14.
19. A computer programme when stored on a data carrier for operating a computer so as to control a metal working machine to perform a hard turning process on a component as claimed in any one of claims 1 to 14.

20. A programmed computer or a computer programme for operating a computer, adapted to control the operation of a metal machining process involving the removal of metal from a rotating workpiece by the engagement therewith of the tip of a metal cutting tool, at least the position of which is controlled by the said computer, and which as a result of synchronised relative movement between the tool and the workpiece, would produce a smooth machined surface thereon, wherein the programme serves to alter the instantaneous position of the tool so as to introduce into the otherwise smooth surface, during the machining process, plural spaced apart depressions for the purpose of simulating a surface typical of that which would be obtained thereon if the latter had been finished by grinding.

21. A metal turning machine in combination with a computer based control system therefor, when programmed to perform a hard turning process on a rotating workpiece involving the removal of metal from the surface thereof by the engagement therewith of the tip of a metal cutting tool, at least the position of which is controlled by the said computer based control system, and which as a result of synchronised relative movement between the tool and the workpiece, would produce a smooth surface thereon, wherein the programme serves to alter the instantaneous position of the tool during the machining process, so as to introduce into the otherwise smooth surface plural spaced apart depressions, for the purpose of simulating a surface typical of that which would be obtained on the workpiece if the latter had been finished by grinding.

22. A method or apparatus according to any one preceding claim, which further comprises gauging and/or measuring the machined part during the machining process, to generate signals indicative of one or more dimensions of the machined part, and supplying the signals to the computer, to assist in the control of the machining process.

23. A machine tool in combination with a computer based control system therefor, when programmed to perform a machining process

on a rotating workpiece, involving the removal of material from the workpiece by the engagement therewith of a cutting tool, at least the position of which is controlled by the said computer based control system and which, as a result of synchronised relative movement between the tool and the workpiece, would produce a smooth surface on the machined part, wherein the programme serves to alter the instantaneous position of the tool so as to introduce into the otherwise smooth surface of the machined part, plural spaced apart depressions during the machining process, for the purpose of simulating a surface typical of that which would be obtained thereon if the latter had been finished by grinding.

24. A machine tool according to claim 23, further comprising at least one gauging or measuring device adapted to perform measurements on the workpiece during the machining process, to generate signals indicative of one or more dimensions of the workpiece, and means for conveying the signals to the computer as feedback signals indicative of how the process is progressing, to assist in the control of the process.

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>C591.01/W</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/GB 00/ 01821</b>	International filing date (day/month/year) <b>12/05/2000</b>	(Earliest) Priority Date (day/month/year) <b>04/06/1999</b>
Applicant  <b>UNOVA U.K. LIMITED et al.</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

### 1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of Invention is lacking** (see Box II).

4. With regard to the **title**,

☐ the text is approved as submitted by the applicant.

☒ the text has been established by this Authority to read as follows:

**HARD TURNING**

5. With regard to the **abstract**,

☐ the text is approved as submitted by the applicant.

☒ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

3

☐ None of the figures.

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/GB 00/01821

Box III TEXT OF THE ABSTRACT (Continuation of item 5 of the first sheet)

Line 1 delete "head" insert "hard"

## INTERNATIONAL SEARCH REPORT

International Application No

PC 00/01821

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 B23B1/00

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B23B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EKSTEDT TERRY: "CHALLENGE OF HARD TURNING" CARBIDE AND TOOL JOURNAL, US, BRIDGEVILLE, PA, vol. 19, no. 5, September 1987 (1987-09), pages 21-24-24, XP002087492 ISSN: 0192-8333 page 21, paragraph 1	1-7, 24-29
X	HASAN RIZWAN: "Why are you still grinding?" MANUFACTURING ENGINEERING, US, DEARBORN, MI, vol. 120, no. 2, 1 February 1998 (1998-02-01), pages 76, 78-80, XP002087491 page 78, middle column	1-7, 24-29

☐ Further documents are listed in the continuation of box C.☐ Patent family members are listed in annex.

## \* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

2 August 2000

Date of mailing of the international search report

11/08/2000

Name and mailing address of the ISA

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Fischer, M

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/01821

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B23B1/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B23B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EKSTEDT TERRY: "CHALLENGE OF HARD TURNING" CARBIDE AND TOOL JOURNAL, US, BRIDGEVILLE, PA, vol. 19, no. 5, September 1987 (1987-09), pages 21-24-24, XP002087492 ISSN: 0192-8333 page 21, paragraph 1	1-7, 24-29
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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

2 August 2000

Date of mailing of the international search report

11/08/2000

Name and mailing address of the ISA

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Authorized officer

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